

METHOD OF OPERATION
FINAL SELECTOR CIRCUIT

With Time Measure Release on Permanent Signals, and Arranged With or Without
Routine Testing on Subscriber's Line - Power Driven Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

The purpose of this circuit is to complete a call coming from an Incoming Selector, thru to a Subscriber's Line, selecting an idle trunk where called line is one of a P.B.X. group, and giving busy back signal where called party is busy.

2. WORKING LIMITS

This circuit is used in offices where the signal battery is from 45 to 50 volts.

OPERATION

3. PRINCIPAL FUNCTIONS

To complete a call from Incoming Selector to Subscriber's Line.

4. CONNECTING CIRCUITS

Incoming Selector Circuit, Subscriber's Line circuit, Miscellaneous tone circuit, selector group Register circuit.

DESCRIPTION OF OPERATION

5. SEIZURE OF FINAL SELECTOR

With the switch in position 1 this circuit is seized by the incoming selector which connects ground to the sleeve, making it test busy to other selectors, and operates the (L) relay thru its 900 ohm winding over the fundamental tip to the sender, battery on L cam brushes 1 and 4, 900 ohm winding, E cam Brush 1, and F cam brush 4 to tip. The (L) relay operated locks thru its make, brushes 2 and 3 cam O and brush 4 cam E and operates the (TK) relay through its 1500 ohm winding brushes 1 and 4 cam S and brushes 1 and 2 cam D. The (TK) relay operated locks thru brushes 1 and 3 cams S, break contact (PBX) relay, brushes 1 and 3 cam R, make contact (TK) relay

to ground on the sleeve of the incoming. The sequence switch is advanced to position 2 thru brushes 2 and 3 cam C to ground on the armature of the (TK) relay operated.

6. BRUSH SELECTION

In position 2 the high speed up magnet is energized thru brushes 1 and 4 cam I, make contact of (L) relay to ground on brush 2 cam D. As the selector advances ground on commutator A is connected and disconnected intermittently to the fundamental tip, shunting down the stepping relay in the sender circuit but holding the (L) relay operated. When the proper number of segments have been passed over the sender opens the fundamental tip releasing the (L) relay and thereby stopping the advance of the selector. The (L) relay released advances the switch to position 3 by ground on the D cam. With the switch in position 3 the trip magnet operates thru brush 4 cam Q to ground on brush 1 cam P. When the sender reaches the position for group selection it places ground on the fundamental tip, reoperating and locking the (L) relay over the same circuit as before. The switch now advances to position 4 thru brush 1 cam J, brush 1 cam I make contact of (L) relay to ground on D cam.

7. GROUP SELECTION - TENS DIGIT

In position 4 ground is again connected to the high speed up drive over the same circuit as before and the selector advances to group selection. The B commutator is now connected to the fundamental tip thru brushes 3 and 4 cam E shunting the stepping relay in the sender circuit in the same manner as for brush selection. The sender opens the fundamental tip releasing the (L) relay and stopping the up drive when the stepping relay has been shunted down the proper number of times. The (L) relay released advances the switch to position 5 thru brush 2 cam B to ground on cam D. When the sender again connects ground to the fundamental tip the (L) relay operates and locks as before advancing the switch to position 6 over brush 1 cam J, brush 1 cam I, make of (L) relay to ground on cam D.

8. UNITS SELECTION

The operation of the circuit is the same as for tens selection except that the switch in position 6 connects the low speed up drive to

break contact of (L) relay to ground on D cam. Ground on the A cam carries to switch to position 8. At position 7 3/4 the (L) relay operates thru its 400 ohm winding, brushes 1 and 3 cam H to ground on the armature of the (TK) relay. The switch advances to position 9 thru brush 1 cam J, brush 1 cam I, make of (L) relay to ground on cam D.

9. TEST OF CALLED LINE

As the switch enters position 8 the sleeve of the called line is tested for one of three conditions (a) not busy (ground on sleeve), (b) individual line or last line of a P.B.X. group busy (battery on sleeve thru low resistance), (c) line in P.B.X. group other than last line busy (battery on sleeve thru high resistance). No relays operate when the sleeve tests "not busy". When the sleeve tests "busy" (either P.B.X. line or otherwise) the (TB) relay operates from ground on cam P, brushes 1 and 2, winding of (P.B.X.) relay, winding of (TB) relay, brushes 2 and 3 cam M, make contact of (L) relay, cam 1 and 4 cam O to battery on sleeve of called line. If the busy line being tested is an individual line or the last line of a P.B.X. group the (CO) relay is connected to its high resistance windings permitting enough battery on the sleeve to operate the (PBX) relay as well as the (TB) relay. If, however, the line is an intermediate line of a P.B.X. group the (CO) relay on the called line is connected to its low resistance winding, acting as a partial shunt to ground and reducing battery on the sleeve so the (PBX) relay, which is marginal will not operate.

10. LINE NOT BUSY

As the switch leaves position 8 the (L) relay releases thru the opening of its holding circuit, thru the 400 ohm winding, at the H cam. Battery from the L cam, brushes 1 and 3, two 18Q resistances, brushes 1 and 2 cam K, break contact of (L) relay, brushes 1 and 4 cam O is placed on the sleeve of the called line, operating the (CO) relay in that circuit and causing it to test busy to hunting selectors. The (L) relay released, also advances the switch to position 12. The (TK) relay advances it to position 13 and the (L) relay to position 14 which is the talking position. As the switch enters position 12 the trip magnet operates, releasing as it leaves position 13.

11. INDIVIDUAL LINE BUSY

The (TB) and (PBX) relays are operated as described in paragraph 9. (PBX) relay operated releases the (TK) relay, 1500 ohms. The (TB) relay operated, holds (L) relay, 900 ohms. As switch leaves 8, (L) relay opens. The (TK) relay released, advances the switch to position 12. The A cam carrying it to 12. As switch enters 9-3/4, (L) relay, 400 ohms, holds. As switch leaves 9-1/2 the (TB) and (PBX) relays release. The (PBX) relay released, reoperates (TK) relay, 1500 ohm, which in turn advances switch to position 13.

Opposite R-4 direction

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12. SELECTION OF IDLE LINE IN P.B.X. GROUP

Assuming first line of group is busy when switch enters 8, (TB) relay operates, holding (L) relay, 900 ohms. As switch leaves 8, (L) relay, 400 ohms, opens. As switch enters 9, low speed (LS) magnet operates, moving elevator upward. As selector brush leaves centered position, "C" commutator makes, holding (TK) relay, 500 ohm and (L) relay, 400 ohms. When idle line is found (TB) relay releases, opening (L) relay, 900 ohms. As selector brush centers on idle line, "C" commutator breaks, opening (TK) relay, 500 ohms, and releasing (L) relay, 400 ohms, which in turn operates called line cut-off relay making called line busy, and releases LS magnet stopping forward movement of selector. The (L) relay released also advances switch to position 10, the A cam carrying it to 12. The switch is advanced from 12 to 13 by the (TK) relay and to 14 (talking) by (L) relay.

13. ALL LINES IN P.B.X. GROUP BUSY

As the selector travels upward, in position 9, as described under paragraph 12, the (TB) relay operates when the first busy line is tested and holds thruout the test of all other busy lines in the group. The "C" commutator makes between centering position of each terminal with group. When brush leaves centered position on next to last line in group, "C" commutator makes, holding (TK) relay, 500 ohms, and (L) relay, 400 ohms. When sleeve of last line is tested, (P.B.X.) relay operates, opening (TK) relay, 1500 ohms. When brush is centered on last line, "C" commutator breaks, (L) relay, 400 ohms, opens, and (TK) relay, 500 ohms, releases, releasing the LS magnet, stopping the forward movement of the selector. The (TK) relay released also advances the switch to 10, the A cam carrying it to 12. As switch enters 9-3/4, (L) relay, 400 ohms, holds. As switch leaves 9-1/2 the (TB) and (P.B.X.) relays release. The (P.B.X.) relay released, reoperates (TK) relay, 1500 ohm, which in turn advances switch to position 13.

14. RETURN ON BUSY

As the sequence switch reaches position 13 after having tested either an individual or all lines of a P.B.X. group busy, the DOWN magnet operates, returning the selector to normal. The R magnet

15. BUSY BACK SIGNAL

With the switch in position 17, the (L) relay (400 ohms) operates and releases under control of interrupted ground, transmitting a busy signal over fundamental to calling station. At the same time a busy tone is also transmitted to calling station. When receiver is replaced on switchhook at calling station, the connections holding the circuit are opened, thereby causing all apparatus in the connection to function to return to normal. As incoming returns to normal, ground is removed from final sleeve, releasing the (TK) relay (1500 ohms) which in turn advances the switch to normal.

16. DISCONNECTION

When the associated incoming selector returns to normal, ground is disconnected from the sleeve, releasing the (TK) relay 500 ohm. The (TK) relay released, reconnects ground from cam P to the sleeve of the incoming selector as a busy condition and advances the switch to position 15.

16.1 When switch enters position 14-1/2 the (L) relay (400 ohm), operates. If the receiver is replaced on the switchhook the (L) relay releases, advancing the switch to position 17, the (TK) relay advancing it to 18. In position 18 the DOWN magnet operates, to normal. When the selector reaches normal the switch is advanced to position 1 from ground on the Y commutator. If the receiver is not replaced on the switchhook, the (L) relay (900 ohm) remains operated in position 15 over the subscriber's loop, and the switch stops in position 15 awaiting the time measure circuit or replacing of receiver on hook. If the receiver is not replaced, the (TK) relay (500 ohm) operates from ground thru F contact of 152-F interrupter, advancing switch to 16. The (TK) relay releases as the switch leaves 16. With the switch in 16, after 28 seconds, the (TK) relay (1500 ohm), reoperates thru the B contact of the interrupter, advancing the switch to 17. The (TK) relay releases as the switch leaves 16 and advances the switch from 17 to 18, where it is advanced to 1 as just described.

the A cam carrying it to 12. The (TK) relay operated, advances the switch to 13. The (L) relay normal, advances the switch to 14. The switch remains in position 14 until the associated incoming selector advances from the talking position when the holding circuit thru the (TK) relay 1500 ohm is opened, releasing the relay which advances switch to 15. The (L) relay, normal, advances the switch to 17, the (TK) relay, normal advancing it to 18. In 18, the DOWN magnet operates, restoring the selector to normal, where ground on the Y commutator brush and segment advances the switch to position 1.

17.2 No Test

On calls from cordless senders when the "No test" feature is desired, the circuit functions as described under paragraphs 5, 6, 7 and 8 until the switch enters position 6-3/4, when the (P.B.X.) relay operates in parallel with 40 ohm resistance from battery thru a low resistance over the ring of the line. The (P.B.X.) relay operated, releases the (TK) relay, 1500 ohms, which advances the switch to position 10 the A cam carrying it to 12, whether or not the called line is busy. The (P.B.X.) relay releases when the switch leaves 7. The (TK) relay 1500 ohm, operates in 12 advancing the switch to 13. From this point on, the circuit functions as described for normal operation.

17.3 Premature Release

Should the receiver at the calling station be replaced on the switchhook at any time before the switch has advanced from 13, the associated incoming selector returns to normal, releasing the (TK) relay. The (TK) relay released, holds the sleeve of this circuit busy and advances the switch to 10, the A cam carrying it to 12. The (TK) relay, 1500 ohm, operates in 12, advancing the switch to 13. The (TK) relay, 1500 ohm, releases when the switch leaves 12. The (TK) relay released, operates the (L) relay, 400 ohm, which in turn operates the DOWN magnet, restoring the selector to normal. When the selector reaches normal, ground on the Y commutator advances the switch to 17, the (TK) relay, normal, advancing it to 18 and the Y Commutator to 1.

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18. P.A.X. DIALING ("X" WIRING)

Where P.A.X. dialing is required the circuit has been so arranged that ground through cam Q may be connected to the ring side of the circuit to complete a fundamental circuit through the stepping relay in the sender circuit for selection into a P.A.X.

19. ROUTINE TESTING OF SUBSCRIBER'S LINE ("W" WIRING)

A portable test set is connected to jacks T-1 and T-2 and TMB at the final frame, by means of patching cords. Ground is connected to the sleeve of the TMB jack, making this final selector test busy to all hunting incoming selectors. The test set supplants the functions of the incoming selector and sender circuits used in completing a regular call. The fundamental circuit is closed through cam T and the tip of Jack T-1, instead of cam F and the tip of the line, as is the case when used on a regular call. With the above exceptions the circuit functions the same, under control of the test set, as described for a regular connection, until the switch reaches position 6, where the path normally used to advance the switch out of 6, being open at the T-1 jack springs, prevents the switch from advancing out of the "units selection" position. In position 6, the tip, ring, and sleeve brushes rest on the terminals of the line to be tested. The sleeve brush being connected to battery from the test set thru the sleeve of jack T-2 holds the selected line busy. The line is tested by means of the testing apparatus being connected to the line through the tip and ring of jack T-2. Other units in the group may be tested by the operation of a "stopping" key in the test set, which closes the fundamental circuit, operating the (L) relay. The (L) relay operated operates the LS magnet, which carries the selector to the next line, when the fundamental circuit is opened in the test set, releasing the (L) relay. Thus the lines in each group of ten are selected step by step. To reset the selector to test in another group of lines, or to restore the circuit to normal, a key in the test set is operated which removes ground from the sleeve of the TMB jack, thus releasing the (TK) relay, in turn advancing the switch to position 13. From this point on, the switch is restored as described under paragraph 16.

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July 8, 1924.

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2.4.4. LAMPING TEST

When P.A.L. dialing is required the circuit has been so arranged that ground through can 2 may be connected to the ring side of the stop relay in order to complete a functional circuit through the stop relay in the sender circuit for selection into a P.A.L.

2.5. ROUTING OF RELAY CIRCUITS

A portable test set is connected to Jacks T-1 and T-2 and the at the final frame, by means of patching cords. Ground is connected to the sleeve of the T-1 Jack, making this final selector test busy to all incoming incoming selectors. The test set supplies the functions of the incoming selector and sender circuits used in completing a relay call. The fundamental circuit is closed through can 2 and the tip of Jack T-1, instead of can 2 and the tip of the line, as in the case when used on a regular call. With the above exceptions the circuit functions the same, under control of the test set, as described for a regular connection, until the switch reaches position 6, where the path normally used to advance the switch out of 6, being open at the T-1 Jack spring, prevents the switch from advancing out of the "test position" position. In position 6, the tip, ring, and sleeve branches rest on the terminals of the line to be tested. The sleeve branch being connected to battery from the test set turn the sleeve of Jack T-2 holds the selected line busy. The line is tested by means of the testing apparatus being connected to the line through the tip and ring of Jack T-2. Other units in the group may be tested by the operation of a "stoppage" key in the test set, which closes the fundamental circuit, operating the stop relay. The (1) relay operated operator the 18 magnet, which carries the selector to the next line, when the fundamental circuit is opened in the test set, releasing the (1) relay. Thus the time in each group of ten are selected step by step. To reset the selector to test in another group of lines, or to remove the circuit to normal, a key in the test set is operated which removes ground from the sleeve of the T-1 Jack, thus releasing the (1) relay in such advancing the switch to position 18. From this point on, the switch is restored as described under paragraph 18.

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